

30. (Amended) A fiber-reinforced article comprised of at least two plies wherein each of said plies comprises (a) rubber and (b) cord made from melt-spinnable, non-metallic, multifilament fiber, said cord having

a twist multiplier of less than or equal to about 375,
a stress at 1% strain greater than or equal to about 1.7 grams/denier, and
an initial compressive modulus greater than or equal to about 7 grams/denier, and
said at least two plies having a ply orientation angle of greater than or equal to about 23°
with respect to the longitudinal direction of the article;

the article further having fiber reinforcement in a third dimension, wherein said third dimension of reinforcement comprises braiding.

REMARKS

Applicants request reconsideration of the restriction requirement and election of species requirement made by the examiner under 35 U.S.C. 121. Applicants have previously provisionally elected claim Group I, including the species directed to claims 1-6, 9-11 and 13-22, wherein the at least two plies is three plies, and the fiber reinforcement in a third dimension is folds forming the edges of the longitudinal direction. This election was made with traverse. It should be noted that the Commissioner may statutorily require the election of inventions "If two or more independent and distinct inventions are claimed in one application." Applicants submit that the examiner has made no showing of distinctness between the embodiments of claim Groups I-IV, or between the species having three plies or four plies. The interpretation in the MPEP 802.01 cannot supersede the clear requirement of the statute that requires inventions to be both independent and distinct in order to support a restriction. It is therefore respectfully urged that the restriction and election requirement be rescinded.

The examiner has rejected claims 29 and 30 under 35 U.S.C. 112, second paragraph. It is submitted that this ground of rejection has been overcome by the instant rejection. Claim 29 has been amended to define that when folds are present, they form the edges of the longitudinal direction of the composite. Claim 30 has been amended to require braiding. In view of this

clarification, it is submitted that the 35 U.S.C. 112, second paragraph rejection has been overcome and should be withdrawn.

Claims 1-3, 9-11 and 16-22 stand rejected under 35 U.S.C. 102 over British Patent Specification 1,310,316. It is respectfully submitted that this ground of rejection is not well taken.

The claims are directed to a fiber-reinforced article comprised of at least two plies wherein each of said plies comprises (a) rubber and (b) cord made from melt-spinnable, non-metallic, multifilament fiber. The cord has a twist multiplier of less than or equal to about 375, a stress at 1% strain greater than or equal to about 1.7 grams/denier, and *an initial compressive modulus greater than or equal to about 7 grams/denier*. Further, the at least two plies have a fiber orientation angle of greater than or equal to about 26° with respect to independent claim 1 and the claims dependent therefrom.

Compressive modulus depends on two factors, the twist multiplier and the denier per filament. As a filament gets larger, the ability to bend goes up markedly, usually by a power of three to four of the diameter. Bending makes a great difference in compressive modulus. One cannot make a high denier per filament for solution spun filaments. The materials of this invention are characterized as having a large denier per filament. It has been unexpectedly found that an article meeting all of the parameter conditions of the claims has increased resistance to the various stresses that arise during use of the article.

British Patent Specification 1,310,316 does not mention compressive modulus. Additionally, they do not mention denier per filament. They certainly do not mention or appreciate the importance of the combination of parameters such as a twist multiplier of less than or equal to about 375, a stress at 1% strain greater than or equal to about 1.7 grams/denier, an initial compressive modulus greater than or equal to about 7 grams/denier, and the at least two plies having a certain ply orientation angle with respect to the longitudinal direction of the article in order to achieve increased resistance to the various stresses that arise during use of the article. The problem to be solved in British 1 310 316 is to optimize the wear-resistivity and the cornering power. In physical terms, "it is necessary to minimize the deformation of the tire tread

when the tire is run along a curved path. To this end, the breaker layer is required to have a high lateral rigidity..." Regarding British 1 310 316, "one of the essential feature of the present invention is to provide for the best combination of the breaker cord material and the angular position of such breaker cords." The present application takes a similar approach by considering both the preferred cord features and the angular position. *However, there is a very significant difference regarding the cord requirements.*

British 1 310 316 follows the conventional wisdom (see page 6, lines 5-7) "that the high Young's modulus of radial tire breakers results in more efficient belting effects. The best way to use given fibers having a high Young's modulus is to use them at a low twisting rate." If one followed that teaching, then one would take an aramid yarn (> 600 g/d modulus) and make a low twist cord. Table I of the present application shows that low twist aramid cords have about a two-fold increase in tensile modulus versus similar low twist PEN cords. However, their compression moduli are about a third of that for PEN. Per the discussion on page 22 of the present application, "tire belts made of such cord would likely have poor tread-wear characteristics and poor cornering coefficient, due to the low compression modulus values." This is supported by the discussion in Column 1, lines 28-44 of the cited patent, U.S. 5,246,051. This Bridgestone patent (U.S. 5,246,051) goes to extraordinary measures (impregnating the filament bundle with the resin) to enhance the compression modulus of textile cords. The applicants accomplish a similar result by merely making sure that the individual filament diameter is sufficiently large to generate the cord compression modulus. This is expressed in our claim limitation stating "an initial compression modulus greater than or equal to about 1.7 grams/denier." This limitation is not mentioned and is not inherent in British 1 310 316.

Like the present application, the British 1 310 316 (page 3, lines 20-26) focuses on increasing the lateral rigidity of the tire breaker. More specifically, British 1 310 316 takes a 1000d PEN yarn, converts it into a treated cord, incorporates the treated cords into rubber sheets, and then builds tires with belt plies at different cord angles. The same PEN yarn was used for all examples, only the cord construction was varied. There are no teachings regarding the importance of compression modulus nor no data to estimate the compression moduli for the PEN cords used. Since PEN is a melt spun fiber, the fiber size (as measured by denier per filament (dpf)) can be

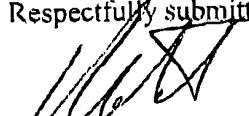
anywhere from the 1-2 dpf range associated with aramid up to the 3-5 range associated with commercial polyester tire yarns. As a result, the PEN cord compression moduli for the '316 patent could be as low as that for aramid. Compression moduli in the presently claimed range are not inherent in the '316 patent and there is no way to determine what they were. For perspective, the PEN used for our patent had "a dpf of about 7" (page 22, line 10).

Note that the resulting tires in British 1 310 316 exhibited optimum cornering power when the cord angles were in the 19-21° range, depending on cord twist and end-count. These optimums occur at lower angles than the 23° widely used for current commercial tires with steel cord belts and, possibly more importantly, much lower angles than the 26° in the modified claim. It is therefore submitted that the 35 U.S.C.102 rejection is legally impermissible since the examiner has not demonstrated that British 1 310 316 anticipates the instant claims.

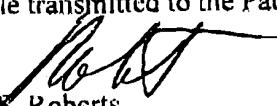
For these reasons it is submitted that this ground of rejection should be rescinded.

The undersigned respectfully requests re-examination of this application and believes it is now in condition for allowance. Such action is requested. If the examiner believes there is any matter which prevents allowance of the present application, it is requested that the undersigned be contacted to arrange for an interview which may expedite prosecution.

Respectfully submitted,


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I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office (FAX No. 703- 305-7115) on March 18, 2003.


Richard S. Roberts

APPENDIXMARKED-UP COPY OF AMENDED CLAIMS

29. (Amended) A fiber-reinforced article comprised of at least two plies wherein each of said plies comprises (a) rubber and (b) cord made from melt-spinnable, non-metallic, multifilament fiber, said cord having

a twist multiplier of less than or equal to about 375,
a stress at 1% strain greater than or equal to about 1.7 grams/denier, and
an initial compressive modulus greater than or equal to about 7 grams/denier, and
said at least two plies having a ply orientation angle of greater than or equal to about 23°
with respect to the longitudinal direction of the article;

the article further having fiber reinforcement in a third dimension, wherein said third dimension of reinforcement comprises stitches or folds, and wherein when folds are present, said folds form the edges of the longitudinal direction of the composite.

30. (Amended) A fiber-reinforced article comprised of at least two plies wherein each of said plies comprises (a) rubber and (b) cord made from melt-spinnable, non-metallic, multifilament fiber, said cord having

a twist multiplier of less than or equal to about 375,
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said at least two plies having a ply orientation angle of greater than or equal to about 23°
with respect to the longitudinal direction of the article;

the article further having fiber reinforcement in a third dimension, wherein said third dimension of reinforcement comprises [stitches or folds, and wherein said third dimension is formed by]
braiding.